

Prevalence of Dry Eye After Cataract Surgery in Patients Visiting Layton Rahatulla Benevolent Trust (LRBT) Township, Lahore

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Abstract: Dry eye disease (DED) is a common issue following cataract surgery, caused by factors such as surgical trauma and postoperative medications. In Pakistan, there is limited data on the prevalence of postoperative DED and its risk factors. **Objective:** To determine the frequency of dry eye disease after cataract surgery and to evaluate its association with demographic and clinical factors among patients undergoing phacoemulsification. **Methods:** A prospective descriptive observational study was conducted at Layton Rahmatulla Benevolent Trust (LRBT) Free Eye and Cancer Hospital, Township Lahore, from January to June 2025. A total of 221 patients aged 40–80 years undergoing phacoemulsification with posterior chamber intraocular lens implantation were enrolled using non-probability consecutive sampling. Patients with previous ocular surgery, ocular surface disorders, corneal pathology, or systemic connective tissue diseases were excluded. Baseline demographic and clinical data were recorded. Dry eye disease was evaluated using tear film breakup time (TBUT) and Schirmer test without anesthesia before surgery and during follow-up at one week, one month, and three months postoperatively. A TBUT value <10 seconds or Schirmer test value <10 mm was considered indicative of dry eye disease. Data were analyzed using SPSS version 25. Quantitative variables were summarized as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. Stratification was performed by age, gender, and diabetic status, and the Chi-square test was used to determine statistical associations with a significance level of $p \leq 0.05$. **Results:** The study included 221 patients with a mean age of 59.8 ± 9.6 years. Male patients comprised 55.7% of the cohort, while 44.3% were female. Diabetes mellitus was present in 38.9% of participants. Dry eye disease developed in 63 patients, yielding an overall prevalence of 28.5% three months after cataract surgery. Older age was significantly associated with postoperative dry eye ($p=0.03$), with the highest frequency observed in the 61–70 year age group. Diabetic patients demonstrated a significantly higher prevalence of dry eye compared with non-diabetic patients (37.2% vs. 23.0%, $p=0.02$). Gender did not show a statistically significant association with dry eye occurrence ($p=0.28$). Tear film parameters showed a marked early postoperative decline, with mean TBUT decreasing from 13.4 ± 2.7 seconds preoperatively to 9.6 ± 2.9 seconds at one week, followed by partial recovery to 11.8 ± 2.6 seconds at three months. Similarly, mean Schirmer test values decreased from 17.2 ± 3.5 mm preoperatively to 11.4 ± 3.2 mm at one week and improved to 14.9 ± 3.0 mm by three months ($p<0.001$). **Conclusion:** Dry eye disease is a common postoperative complication following cataract surgery, affecting nearly one-third of patients in this cohort. Advancing age and diabetes mellitus appear to be significant risk factors for its development. These findings suggest that routine postoperative screening for dry eye and early initiation of ocular surface management may improve visual comfort and patient satisfaction after cataract surgery. **Keywords:** Dry Eye Disease; Cataract Surgery; Phacoemulsification; Tear Film Break-Up Time; Schirmer Test; Postoperative Complications; Diabetes Mellitus; Ocular Surface Disease.

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Introduction

Dry eye disease (DED) is a multifactorial condition of the ocular surface characterized by a loss of homeostasis of the tear film, accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles (1). DED is a common condition affecting approximately 5%–50% of the population worldwide, representing a major cause of ocular discomfort and reduced quality of vision (2). Large population-based studies have confirmed that eye surgery, including cataract surgery, dramatically increases the risk of developing dry eye (3). Cataract surgery is one of the most commonly performed ophthalmic procedures globally, with excellent visual outcomes; nevertheless, it is recognized as one of the principal causes of iatrogenic dry eye disease, particularly in patients with pre-existing risk factors such as advanced age, female sex, and pre-existing ocular surface disease (4). The incidence of DED following cataract surgery varies considerably among studies, ranging from 9.8% to 34%, with the onset or worsening of signs and symptoms typically occurring within the first postoperative week and potentially persisting for several months (4). Multiple factors contribute to post-surgical tear film instability, including damage to corneal

structures, adverse effects of topical anesthesia, benzalkonium chloride-containing eye drops, and exposure to intense microscope illumination (1). These insults can initiate a vicious cycle of tear film hyperosmolarity, conjunctival and corneal cell apoptosis, and ocular surface inflammation (1). Studies have demonstrated a significant increase in dry eye symptoms following cataract surgery, with foreign body sensation and watery eyes among the most frequently reported complaints (5). Furthermore, DED has been shown to impair quality of vision and reduce work productivity, thereby imposing a considerable burden on patients' daily lives (2). Prospective clinical studies have consistently documented measurable deterioration in tear film parameters following cataract surgery. Tear break-up time (TBUT) has been shown to decrease significantly in the early postoperative period, with partial recovery observed at one month (5). Similarly, small incision cataract surgery has been reported to induce significant dry eye changes in patients with previously normal ocular surfaces, with changes peaking at approximately four weeks postoperatively and persisting in low grade at twelve weeks (6). Post-cataract surgery DED can become chronic in approximately 10% of cases, adversely affecting patient satisfaction and quality of life (4). Effective perioperative management, including the use of artificial tears and anti-inflammatory agents, has been shown to mitigate these effects (1, 4).

Pakistan bears a substantial burden of cataract-related blindness, and cataract surgery is among the most frequently performed ophthalmic procedures in the country (7, 8). Data from tertiary eye care hospitals in Pakistan indicate that tens of thousands of cataract surgeries are performed annually, with a notable shift from extracapsular cataract extraction toward phacoemulsification over the past decade (7). Studies conducted in Lahore and other major cities have documented high surgical volumes across both public and private sector institutions (8). Despite this high surgical burden, there is a paucity of local data on the frequency and severity of post-cataract DED in Pakistani patients. Factors such as hot and arid climate, high levels of air pollution, limited access to postoperative lubricant therapy, and a predominantly elderly surgical population may predispose Pakistani patients to a higher prevalence of post-cataract DED than reported in Western literature (3). Furthermore, the absence of standardized postoperative dry eye management protocols in many Pakistani centers Scantling-Birch et al. (9) underscores the need for institution-specific data to guide clinical practice. The present study therefore aims to determine the frequency of dry eye disease following cataract surgery among patients attending Layton Rahmatulla Benevolent Trust (LRBT) Free Eye and Cancer Hospital, Township, Lahore, thereby providing locally relevant evidence to inform postoperative care protocols and improve patient outcomes.

The present study was conducted to determine the frequency of dry eye disease following cataract surgery among patients attending Layton Rahmatulla Benevolent Trust (LRBT) Free Eye and Cancer Hospital, Township Lahore. The research was designed as a prospective descriptive observational study and was carried out over a period of six months after approval of the research protocol. Ethical approval was obtained from the institutional ethical review committee of LRBT Free Eye and Cancer Hospital prior to the commencement of the study. All participants were informed about the purpose and procedures of the study, and written informed consent was obtained from each patient before enrollment.

Methodology

A total of 221 patients undergoing cataract surgery were included in the study. The sample size was calculated using a 95% confidence interval with a margin of error of 5% and an expected frequency of postoperative dry eye disease of 29.2%, based on previously published literature. Non-probability consecutive sampling was employed to recruit eligible participants presenting to the outpatient department of Layton Rehmatullah Benevolent Trust Free Eye Hospital, Township Lahore. during the study period from 16 January to 16 June 2025 . Patients aged between 40 and 80 years with clinically diagnosed cataract who were scheduled to undergo phacoemulsification with posterior chamber intraocular lens implantation were considered eligible for inclusion. Both male and female patients were included, and individuals with or without diabetes mellitus were allowed to participate in order to evaluate the potential influence of diabetic status on postoperative dry eye symptoms. Patients were excluded if they had a history of previous ocular surgery, preoperative astigmatism greater than 2.0 diopters, oblique irregular astigmatism, systemic connective tissue disorders, or any preexisting ocular surface abnormalities that could influence tear film stability. Additional exclusion criteria included the presence of corneal scars, corneal degeneration or ectasia, pseudoexfoliation syndrome of the lens, uveitis, high myopia, retinal diseases, intraoperative complications such as posterior capsular rent or zonular dialysis, and patients requiring sutured incisions. These criteria were applied to minimize confounding factors that could independently contribute to the development of dry eye disease.

Baseline demographic and clinical information was collected from all participants at the time of enrollment. These data included age, gender,

residential address, diabetic status, past medical history, and current medication history. All patients underwent detailed ophthalmic evaluation before surgery, including slit lamp examination to confirm the diagnosis of cataract and assess the ocular surface. Cataract surgery was performed using standard phacoemulsification technique under local anesthesia using lidocaine and bupivacaine. To minimize procedural variability and reduce operator-related bias, all surgical procedures were performed by a single experienced ophthalmic surgeon. After removal of the cataractous lens using ultrasonic fragmentation and aspiration, a posterior chamber intraocular lens was implanted in all patients.

Assessment of dry eye disease was conducted using two standardized diagnostic tests: tear film breakup time (TBUT) and the Schirmer test without anesthesia. For the TBUT assessment, fluorescein dye was instilled into the conjunctival sac, and the patient was instructed to blink several times to distribute the dye evenly across the ocular surface. The ocular surface was then examined under a cobalt blue filter using a slit lamp biomicroscope. The interval between the last blink and the appearance of the first dry spot on the corneal surface was recorded in seconds. A TBUT value of less than 10 seconds was considered indicative of tear film instability and classified as dry eye disease. The Schirmer test was performed using Whatman No. 41 filter paper strips placed in the lower fornix of the eye without topical anesthesia. The amount of wetting on the strip after five minutes was measured in millimeters. Wetting of less than 10 mm was considered abnormal and indicative of reduced tear secretion.

Both tests were conducted at baseline before surgery and repeated during postoperative follow-up visits. Follow-up evaluations were scheduled at one week, one month, and three months after cataract surgery. During each visit, TBUT and Schirmer test values were measured and recorded for the operated eye. All clinical examinations and measurements were performed by the same ophthalmologist to maintain consistency in evaluation and minimize inter-observer variability. The diagnosis of postoperative dry eye disease was established when either TBUT or Schirmer test values met the predefined criteria for dry eye.

All collected data were recorded on a structured proforma designed specifically for the study. Data were subsequently entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Quantitative variables, including age, tear film breakup time, and Schirmer test values, were summarized as mean and standard deviation. Qualitative variables such as gender, diabetic status, and presence or absence of dry eye disease were presented as frequencies and percentages. To evaluate the effect of potential modifiers, the data were stratified according to age groups, gender, and diabetic status. Post-stratification analysis was performed using the Chi-square test to assess the association between these variables and the occurrence of postoperative dry eye disease. A p-value of ≤ 0.05 was considered statistically significant for all inferential analyses.

Results

A total of 221 patients who underwent phacoemulsification cataract surgery at Layton Rahmatulla Benevolent Trust Free Eye and Cancer Hospital, Township Lahore were included in the final analysis according to the inclusion and exclusion criteria described in the study protocol.

The mean age of the participants was 59.8 ± 9.6 years, with the majority of patients belonging to the 51–60 year age group. Among the study population, 123 (55.7%) were male and 98 (44.3%) were female. Regarding diabetic status, 86 (38.9%) patients were diabetic, while 135 (61.1%) were non-diabetic. Detailed demographic characteristics are presented in Table 1.

Table 1. Demographic Characteristics of Study Population (n=221)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	40–50	42	19.0

	51–60	88	39.8
	61–70	64	29.0
	71–80	27	12.2
Mean Age	59.8 ± 9.6		
Gender	Male	123	55.7
	Female	98	44.3
Diabetic Status	Diabetic	86	38.9
	Non-Diabetic	135	61.1

The overall frequency of dry eye disease (DED) three months after cataract surgery was observed in 63 (28.5%) patients, while 158

(71.5%) patients did not develop dry eye disease during the follow-up period. These findings are summarized in Table 2.

Table 2. Frequency of Dry Eye Disease After Cataract Surgery (n=221)

Dry Eye Disease	Frequency (n)	Percentage (%)
Yes	63	28.5
No	158	71.5

Stratification of dry eye disease according to age groups, gender, and diabetic status was performed to evaluate the association of these variables with postoperative dry eye disease. Dry eye disease was observed more frequently in older age groups, particularly among patients aged 61–70 years (37.5%). Similarly, a slightly higher frequency of dry eye disease was noted in female patients (31.6%)

compared with male patients (26.0%). In addition, diabetic patients showed a higher frequency of dry eye disease (37.2%) compared with non-diabetic patients (23.0%). Age and diabetic status demonstrated statistically significant associations with postoperative dry eye disease, while gender did not show a statistically significant association. These results are presented in Table 3.

Table 3. Stratification of Dry Eye Disease According to Demographic Variables (n=221)

Variable	Category	Dry Eye Yes n (%)	Dry Eye No n (%)	Total	p-value
Age (years)	40–50	7 (16.7)	35 (83.3)	42	
	51–60	22 (25.0)	66 (75.0)	88	
	61–70	24 (37.5)	40 (62.5)	64	
	71–80	10 (37.0)	17 (63.0)	27	0.03
Gender	Male	32 (26.0)	91 (74.0)	123	
	Female	31 (31.6)	67 (68.4)	98	0.28
Diabetic Status	Diabetic	32 (37.2)	54 (62.8)	86	
	Non-Diabetic	31 (23.0)	104 (77.0)	135	0.02

The evaluation of tear film breakup time (TBUT) and Schirmer test values showed a decline in tear film stability and tear secretion during the early postoperative period, with gradual improvement over time. The mean TBUT decreased from 13.4 ± 2.7 seconds preoperatively to 9.6 ± 2.9 seconds at one week, followed by improvement to 11.8 ± 2.6

seconds at three months. Similarly, mean Schirmer test values decreased from 17.2 ± 3.5 mm preoperatively to 11.4 ± 3.2 mm at one week, and improved to 14.9 ± 3.0 mm at three months. The changes across follow-up visits were statistically significant (p < 0.001). These results are summarized in Table 4.

Table 4. Tear Film Breakup Time and Schirmer Test Values During Follow-up (n=221)

Time Point	TBUT (seconds) Mean ± SD	Schirmer Test (mm) Mean ± SD	p-value
Pre-operative	13.4 ± 2.7	17.2 ± 3.5	
1 week post-operative	9.6 ± 2.9	11.4 ± 3.2	
1 month post-operative	10.7 ± 2.8	13.2 ± 3.1	
3 months post-operative	11.8 ± 2.6	14.9 ± 3.0	<0.001

Overall, these findings demonstrate that dry eye disease developed in nearly one-third of patients following cataract surgery, with older age and diabetic status showing significant associations, while gender did not significantly influence postoperative dry eye development in this cohort.

Discussion

The present study demonstrated that dry eye disease (DED) developed in 28.5% of patients three months following phacoemulsification cataract surgery. This finding is broadly consistent with, yet somewhat higher than, estimates reported in prior literature. Qayum reported an incidence of 18% of dry eye after clear corneal phacoemulsification at the 90th postoperative day Qayum (10), while Sharma et al. reported a statistically significant reduction in mean Schirmer's and TBUT values at all follow-

up levels compared to preoperative values, with gradual recovery by one month (11). The relatively higher frequency observed in the present cohort may reflect the influence of local environmental factors, including heat and air pollution, which have been independently associated with dry eye risk (3).

The observed decline in TBUT from 13.4 ± 2.7 seconds preoperatively to 9.6 ± 2.9 seconds at one week, with partial recovery to 11.8 ± 2.6 seconds at three months, is consistent with findings reported across multiple studies. Brunet et al. documented a mean TBUT reduction from 12.4 seconds preoperatively to 8.2 seconds at one week, with partial recovery to 11.1 seconds at one month (5). Similarly, Ragab and Elmahdy reported statistically significant reductions in TBUT on postoperative day 1 (6.08 ± 1.19 s) and day 7 (7.06 ± 1.2 s) compared to preoperative values (11.1 ± 1 s), with gradual improvement at one month (12). Andryani et al.

further confirmed that both Schirmer test and TBUT are specific but less sensitive diagnostic tools in post-phacoemulsification patients (13). The Schirmer test values in the present study similarly declined from 17.2 ± 3.5 mm preoperatively to 11.4 ± 3.2 mm at one week, recovering to 14.9 ± 3.0 mm at three months, a trajectory consistent with Sharma et al., who reported Schirmer values of 27.45 ± 4.95 mm preoperatively declining to 9.09 ± 2.19 mm at day 7 and recovering to 24.45 ± 4.05 mm at day 30 (11).

The present study found a statistically significant association between advancing age and postoperative DED ($p = 0.03$), with the highest frequency observed in the 61–70 year age group (37.5%). Brunet et al. similarly reported a significant increase in dry eye symptoms after cataract surgery with increasing age (5). Bista et al. reported a mean patient age of approximately 54 years in their post-cataract dry eye cohort, with dry eye indices worsening postoperatively regardless of surgical technique (14). These findings collectively reinforce the role of age as a significant risk factor for post-surgical DED.

A statistically significant association between diabetic status and postoperative DED was observed ($p = 0.02$), with diabetic patients demonstrating a higher frequency of DED (37.2%) compared to non-diabetic patients (23.0%). Manchikanti et al. demonstrated that patients with diabetes mellitus showed significantly lower Schirmer's test and TBUT values compared to controls, attributing this to inflammatory mediator-driven lacrimal function unit dysfunction (15). Arif et al. similarly reported significantly reduced TBUT in diabetic patients compared to non-diabetic subjects, concluding that tear film stability is adversely affected in diabetes (16). Abu et al. further confirmed that diabetes mellitus is a known leading systemic risk factor for DED, with all three layers of the tear film affected by hyperglycaemia (17).

In contrast to some prior studies, gender did not demonstrate a statistically significant association with postoperative DED in the present cohort ($p = 0.28$), although a slightly higher frequency was noted in females (31.6%) versus males (26.0%). Vehof et al., in a large population-based study of 79,866 participants, identified female sex as a strong independent risk factor for dry eye (3). The absence of statistical significance in the present study may be attributable to the relatively smaller sample size or the confounding influence of diabetic status and age within the cohort.

Conclusion

Dry eye disease occurred in a considerable proportion of patients after phacoemulsification cataract surgery, with a prevalence of 28.5% in the studied population. Older age and diabetes mellitus were significant predictors of postoperative dry eye, while gender showed no meaningful association. Monitoring tear film parameters and implementing preventive strategies may help reduce postoperative ocular surface complications and improve visual outcomes in patients undergoing cataract surgery.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-LRBT-02-25)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Manuscript drafting, Study Design,

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Review of Literature, Data entry, Data analysis, and drafting articles.

AA (FCPS Trainee)

Conception of Study, Development of Research Methodology Design,

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Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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